

**The d
to the**

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- The impossibility of the film**

Origin
begin
the la
sion,
other
first p
sion,
or illu

**The la
shall o
TINUR
which**

Maps,
differ
entire
begin
right,
requir
metho

10X		14X		18X		22X		26X		30X	
							✓				
12X		16X		20X		24X		28X		32X	

REPORT

To the
Mi

SIR,—
results ob
taken und

The
the Gulf of
History of
dredging
entrance
depths th

In 1
Bay, by n
three dre
some exp
Bay in 18
attention
further
Jeffreys,
of a nove
procured
of 1869,
in Gaspé
John Luc
Gréve) re
power to
operation
Rosier vi
lections v
of the fo
results of
illustrati

Man
St. Lawr
with the
subordin
been ma
mer of 1
no one e
sea leads
Principa
polycyst
of the se
attention
to ascert

REPORT ON A DEEP SEA DREDGING EXPEDITION TO THE GULF OF
ST. LAWRENCE, BY J. F. WHITEAVES, F.G.S., &c.

To the Hon. PETER MITCHELL,

Minister of Marine and Fisheries for the Dominion of Canada, &c., &c.

SIR,—I have the honor to submit the accompanying report, descriptive of some of the results obtained in a deep sea dredging expedition round the Island of Anticosti, undertaken under your auspices, and on behalf of the Natural History Society of Montreal.

Your obedient Servant,

J. F. WHITEAVES.

INTRODUCTORY.

The most important contribution to our knowledge of the marine animals inhabiting the Gulf of St. Lawrence, was made by Dr. A. S. Packard, Jun., to the Boston Natural History Society, in October, 1865, and printed in their Memoirs in 1867. Extensive dredging operations were carried on by that gentleman on the Labrador coast, near the entrance to the Straits of Belle Isle; but although large collections were made, no greater depths than from fifty to sixty fathoms were examined.

In 1867, I devoted a fortnight to the examination of the bottom of the sea in Gaspé Bay, by means of a dredge, with very decided success. I had previously undertaken three dredging expeditions in various parts of the British seas, so that I already had some experience in such matters. The greater part of the specimens obtained in Gaspé Bay in 1867, were taken by me to London in 1868, where they excited considerable attention among naturalists, who kindly volunteered practical assistance in the further prosecution of these researches. I am specially indebted to J. Gwyn Jeffreys, Esq., F.R.S., for the gift of a dredge of the latest pattern, fitted up with bags of a novel description, which were subsequently found to be of great utility. Having procured the latest apparatus for the purpose while in England, in the summer of 1869, I again went down to Gaspé, and devoted six weeks exclusively to dredging in Gaspé Bay and its vicinity. As in 1867, so in 1869, my kind friends, Messrs. John Luce and P. de Carteret (of the firm of Messrs. W. Fruing and Co., of Grande Grève) received me with the utmost hospitality, and gave me every assistance in their power towards carrying out the objects I had in view. Every available day dredging operations were carried on, and two cod banks, situated between Cape Gaspé and Cap Rosier village, but about five miles from the shore, were carefully examined. Large collections were made, and since 1867 I have devoted nearly all my spare time to the study of the foraminifera, sponges, polyzoa, and mollusca, obtained in these two expeditions, the results of which I hope soon to publish. Microscopical preparations have been made illustrative of the first three of these groups, and careful dissections of a number of the last.

Many interesting marine animals have also been collected in the River and Gulf of the St. Lawrence, by Principal Dawson, Professor R. Bell, and Mr. John Richardson, Jun., but with these gentlemen dredging operations and marine zoology have been for the most part subordinate to special geological investigations. No researches with the dredge have ever been made in the deeper parts of the River or Gulf of the St. Lawrence until the summer of 1871. I had only succeeded in dredging as deep as fifty fathoms, and believe that no one else had dredged much deeper, if any. Five samples of mud brought up by deep sea leads, from depths of from 100 to 313 fathoms in the Gulf, (in the possession of Principal Dawson) containing a few diatoms, some small foraminifera, and two species of polycystinæ, represented all that was known (up to 1870) of the fauna of the abyssal zone of the seas of the Dominion. During the winters of 1867 and 1871, I called the special attention of the Society which I have the honor to represent, to the importance of trying to ascertain, by dredging, the nature of the animal and vegetable life inhabiting the greater

depths of the St. Lawrence, and endeavoured to show that such investigations would not only be of great scientific interest, but that they could scarcely fail to be of considerable practical value. Principal Dawson also, as President of the Society, has often advocated similar views, and in June, 1871, I was delighted to hear that he had spoken to you on the subject, and that you, at once appreciating the importance of such researches, had promised every assistance in your power towards the carrying of them out. Principal Dawson requested me to undertake the superintendence of the expedition, (on behalf of the Natural History Society of Montreal), and my friend, Mr. G. T. Kennedy, B.A., an enthusiastic and skilled zoologist, went with me in the interests of McGill College. Unfortunately he was compelled to return to Montreal, after he had been eight days at sea, and I thus lost his valuable services and was left quite alone the greater part of the time, so far as scientific help was concerned. Having plenty of time to make preparations, we took everything that experience, gained in five previous expeditions of the kind, suggested. It having been previously arranged that we were to meet Commander Lavoie at Father Point on the 6th of July, we left Montreal on the 3rd of that month. The following report is arranged in three parts. The first part consists of extracts from a diary kept on board *La Canadienne* and the *Stella Maris*; the second gives a preliminary summary of the zoological results obtained; whilst the third and last part is devoted to practical suggestions and concluding remarks. It may be well to remark that as these investigations were entirely subordinate to the special duties upon which the schooners were engaged, dredging could only be carried on at intervals, and in several cases the same ground was gone over twice or more.

PART I.

[(A.) Abstract of Diary kept on board *La Canadienne*.]

Thursday, July 6th, 1871. Got on board *La Canadienne* at Father Point, a little before noon, and were exceedingly kindly received by everyone. Sailed for the north shore about noon and spent the afternoon preparing one of the dredges for use.

Friday, July 7th. Anchored in Trinity Bay all day; weather cold and rainy. The Laurentian hills visible on shore in the distance; saw two black guillemots during the day. Specimens of *Lunatia heros* and *Maetra polyneuma* were collected on the beach by a party who went ashore.

Saturday, July 8th. Made two unsuccessful trials with the dredge in 25 fathoms off Trinity Bay; we attributed the failures to the buoyancy of the rope, which was made of cocoa nut fibre. A deep sea lead was lashed to the line a fathom or two in front of the dredge, which obviated the difficulty. Dredge No. 1. (Omitting the unsuccessful ones), 25 fathoms sand in Trinity Bay. Twenty-one species of shells and a few large sandy foraminifera (*Lituolæ*) came up in this haul. Being anxious to try deeper water, another deep sea lead was lashed to the line about 50 fathoms from the first, and we stood out a little further from shore. Dredge No. 2. Half way between Point des Monts and the west end of Trinity Bay, in 96 fathoms, small stones and coarse sand. Number of species considerable; shells fourteen; many rare polyzoa, crustacea, star fishes and three interesting sponges. No microscopical organisms in the sand. A young Norway haddock came up alive in this haul.

Sunday, July 9th. At anchor in Seven Island Bay all day.

Monday, July 10th. No dredging done to-day.

Tuesday, July 11th. Dredge Nos. 3 and 4. Off Seven Island Bay, 12 $\frac{3}{4}$ miles from shore, 164 fathoms clayey mud. Seven species of shells, many marine worms, a few small crustaceans, a brittle star and a *Dentalina* were obtained in these two hauls. Saw several petrels during the day, but not close enough to distinguish the species.

Wednesday, July 12th. No dredging to-day; many whales and black porpoises seen. A towing net was used for many hours but almost nothing was caught in it.

Thursday, July 13th. Landed at Moisie Village in the morning, saw many capelins and sand launces brought ashore in a net. Dredge No. 5. 70 fathoms sand, off Moisie

Village, so things. D almost en visible to

Frida bag of wh so well th this point brought u 170 fatho ing the th process, th lower had deeper int of curious past Poin Satu

Egg Islan deck in (Ctenodis

Sund Mon

30 fatho few inter in the sa

Tues specimen crab, *Chi* a male B were pro of Antic deck the were not

We sand. Th water sp

Thu Fri

ber Islan rare and such as usual an Anticos

Sat

end of t number mens of such as &c.; a f be low. (No. 12 involve fou on

* To p

Village, seven to eight miles from shore. Twenty-one species of shells and several other things. Dredge No. 6. Fourteen miles from shore, 100 fathoms mud, the bag came up almost empty, there was in it only a small quantity of mud containing no organisms visible to the naked eye. Mr. Kennedy left for Montreal this evening.

Friday, July 14th. Employed this day, for the first time, a new dredge, the frame and bag of which I had had made under my own immediate supervision in Montreal. It worked so well that the other was discarded and put aside as a reserve in case of accident. At this point I took observations, as well as I could, of the temperature of the mud or sand brought up from various depths. Dredge No. 7. Off Caribou Island, ten miles distant, 170 fathoms mud. The temperature on deck, in the shade, was 53° Fahr.*; and on plunging the thermometer in the mud brought up, and shading both with a tarpaulin during the process, the mercury sank to 37° . It is probable that it would have fallen a degree or two lower had the instrument been self-registering, or if the bulb could have been immersed deeper into the mud. Eight species of shells, five of which are new to Canada, and a number of curious marine worms were obtained this time. During the day we had sailed back past Point des Monts.

Saturday, July 15th. Returning from Point des Monts, we got dredge No. 8, off Egg Island, eight miles from shore, in 70 to 80 fathoms sandy mud. Temperature on deck in the shade 58° ; in the mud, 37° . Eleven species of shells, two star-fishes (*Ctenodiscus*) and a sea-anemone in this haul.

Sunday, July 16th. Anchored in Seven Island Bay all day.

Monday, July 17th. Off Sawhill Point and River in the morning. Dredge No. 9. 30 fathoms sand, two miles distant from Sawhill Point. Thirteen species of shells, a few interesting hydrozoa (*Thuiaria*) polyzoa, &c. Temperature on deck in the shade 59° ; in the sand, 37° .

Tuesday, July 18th. Ashore at Magpie Village in the morning; collected many specimens of *Ceronia deaurata*, on the beach, and found one fine example of the great spider crab, *Chionocetes opilio*. Commander Lavoie bought from a man on shore, specimens of a male Barrow's Golden Eye, and a pair each of the Common and King Eider Duck, which were probably shot on the spot. Dredge 10. Off St. John's River, near the West Point of Anticosti, in 60 fathoms sand. Temperature of the sand 37° , while in the shade on deck the mercury registered 56° . The species brought up in this haul, though numerous, were not of special interest.

Wednesday, July 19th. Dredge No. 11. Off St. John's River in 50 fathoms sand. Temperature on deck in the shade 52° , in the sand 37° . The usual shallow water species with a few novelties. Fog and calm part of the day.

Thursday, July 20th. Anchored off St. John's River all day. Dead calm and fog.

Friday, July 21st. In the morning tried to collect some Calciferous fossils on Harber Island, Mingan, but without success, as at the place where I landed, fossils were both rare and badly preserved. Observed many interesting plants on the rocks near the beach, such as *Sedum rhodiola*, *Mitella nuda*, *Primula farinosa*, *Pinguicula vulgaris*, also the usual and characteristic maritime plants. In the afternoon we set sail for English Bay, Anticosti.

Saturday, July 22nd. Ashore at English Bay, Anticosti, in the morning. At each end of the bay good sections of rocks, of the Hudson River Group age, face the sea. A number of loose blocks of stone (of the same formation) were lying on the beach. Specimens of the characteristic fossils of the period were collected from these drifted masses, such as *Asaphus platycephalus*, a small *Murchisonia*, *Orthis testudinaria*, *Leptæna sericea*, &c.; a few interesting shells, crustaceans &c., were also collected, as the tide happened to be low. In the afternoon we tried two hauls of the dredge, Nos. 12 and 13. The first (No. 12) was in 25 fathoms, on a rocky bottom, off English Bay, and here the principle involved in the construction of the new dredge was successfully tested. The scraper got fouled on a ledge of rocks, but as the arms of the dredge were only tied together with rope

* To prevent reiteration, it may be as well to state that wherever degrees are mentioned in this report, degrees Fahrenheit are intended.

yarn, the strands broke with the strain, and the dredge came up end ways, empty of course, but uninjured. Dredge No. 13 was in 60 fathoms water, a little to the N. E. of the spot previously tried, but all that was obtained was a single shell, and a few small stones covered with a parasitic foraminifer (*Truncatulina*) but nothing else. Dredging between the West end of Anticosti and the north shore of the St. Lawrence is difficult, as the bottom, in most cases, is bare rock. Sailed for St. John's River, and anchored there at night.

Sunday, July 23rd. Anchored off St. John's River all day. Went ashore in the morning, observed a salmon making his way up for the river; noticed also large shoals of capelin, many seals, and a few puffins.

Monday, July 24th. Still at anchor off the St. John's River; fog and no wind. Fished for cod in the morning, and noticed that nearly all the fish taken had nematoid worms encysted on the outside of their livers; preserved specimens of these for microscopical examination. It was our intention to have proceeded as far as Natashquan, then to have tried the deepest water in the gulf (313 fathoms) situate at a spot half way between the east end of Anticosti and the Bird Rocks, and after a short time, devoted entirely to dredging in very deep water to the south of Anticosti, to have made for Gaspé Basin, in order that I might return home from that point. Our plans, however, were entirely changed; for in the afternoon an American schooner was captured illegally fishing near the shore, and the commander decided at once to take her to Gaspé Basin or Percé. We set sail accordingly for the south shore of the St. Lawrence at 6 p.m.

Tuesday, July 25th. Still making for Gaspé Basin, with very little wind. In the afternoon got Dredge No. 14, off the West Point of Anticosti, twenty-four miles from the lighthouse, bearing N.N.E., in 200 fathoms mud. Many annelids, a few star fishes, two or three shrimps and six species of shells, but so little mud, that when the bulb of the thermometer was plunged into it there was barely enough to cover it, consequently the mercury did not fall so low as usual. The temperature on deck in the shade was 66°, in the mud it only "to 50°.

Wednesday, July 26th. Close to Cap Rosier lighthouse in the morning. Dredge No. 15, (the most successful haul on board *La Canadienne*) in 125 fathoms mud, six miles from shore, immediately opposite Cap Rosier lighthouse. Temperature on deck in the shade 64°, in the mud 38°. Many large specimens of Sar's brittle star and of *Ophiacantha spinulosa* in this haul, also other rare and fine echinoderms, a large *Nymphon*, ten species of shells, &c., &c., quite a number not only of species but also of individuals. We then endeavoured to find a "reef," or cod bank, which runs out to sea between Ship Head and Cape Bon Ami, upon which, in 1869, I had collected a number of rare and new marine sponges, shells, &c., but we failed to find it. Dredge No. 16, the last on board *La Canadienne*, was off Cap Bon Ami, six miles from shore, on a stony bottom, in thirty fathoms water. Not much came up this time, a few stones and five or six species of shells. Anchored in Gaspé Bay at night and, in the morning I went ashore.

In Gaspé Basin.

Commander Lavoie having kindly given me a letter to Captain Lachance I determined to wait for the *Stella Maris*. Mr. Jos. Eden telegraphed to Paspébiac, but unfortunately the schooner had left that place before the telegram arrived. Waited a fortnight in Gaspé Basin, during which time I got one good days dredging in the bay, and early on the morning of Friday, August 11th, I started on cruise No. 2, on board the *Stella Maris*.

B.—Abstract of Diary on board the Stella Maris.

For convenience of reference, the hauls of the dredge on *La Canadienne* are designated by numbers, those on board the *Stella Maris* by letters of the alphabet. As there was no deep sea lead on the *Stella Maris*, the depths greater than sixty fathoms are taken from the charts.

Friday, August 11th. Sailed from Gaspé Basin at about 3 a.m., and about the middle of the day got Dredge A., in thirty-eight fathoms water, (measured) bottom of small stones, Cape Gaspé W. $\frac{1}{2}$ S., Cape des Rosiers N.W. by N., about five miles from shore. Many fine large specimens of the "crumb of bread" sponge, sea-urelins, star fish, crabs of the genus *Hyas*, *Polyzoa*, and about twenty-five species of shells, five of which are very rare, came up this time. The number both of individual specimens and of species very large; a bottom composed of small stones being usually the most productive of all kinds of ground. The dredge was down an hour and a quarter, but the wind was so slight that the scraper anchored the schooner for some time. Dead calm about 1 p.m., which lasted twenty-four hours.

Saturday, August 12th. A light N.W. breeze springing up at 12.15 p.m., enabled us to resume operations. Dredge B. Between Cap Rosier and Griffins Cove, eighteen miles from shore, 120 fathoms. After remaining at the bottom an hour, when it was hauled up, the bag proved to be almost empty—two marine worms and a broken brittle star were all that it contained. We tried again in the same place, but with still worse success, for in Dredge C there was absolutely nothing.

Sunday, August 13th. Sailed along the S.W. shore of Anticosti as far west as the West Point lighthouse, and anchored at night in Ellis Bay. Fine sections of Lower Silurian rocks face the sea here; during the day observed many gannets diving. A long reef of rock extends seawards to the west of Ellis Bay, and this, as was also the beach to the east of it, is dotted over with large boulders.

Monday, August 14th. Rose at 6 a.m., and went to examine the limestone reef mentioned above, the tide being low, but did not find any fossils, or any marine animals of special interest. Clouds of wading birds, plovers, sandpipers, &c., were feeding in the bay; many seals, and a few foolish guillemots were also observed. The limestone in this bay is perfectly riddled with the burrows of *Saxicava* (a boring bivalve), and small crabs (*Cancer borealis*?) are abundant near the shore. Sea-weeds, also, were very plentiful here, amongst them, gigantic fronds of *Laminaria* six to ten feet long or more. Returned to the ship and went ashore at the east end of the bay later in the morning, but landed with difficulty, owing to the extreme shallowness of the water. The land is low, but well wooded, the trees, however, are very small. Few plants of any special interest were noticed. *Zygadenus glaucus* was abundant and in full flower. There appeared to be an exposure of rock at the east end of the bay, but there was not time to walk to it. Many pieces of limestone were lying on the beach, containing common but well preserved fossils of the Hudson River Group. Living specimens of *Helic nemoralis*, var *hortensis* (a common European snail) were collected. At 3 p.m., we sailed for the south shore.

Tuesday, August 15th. On rising, I found that the dredge had been thrown over at 4.30 a.m., and that it had been hauled up nearly full, before I was up. Dredge D, Ellis Bay, Anticosti, bearing S.W., twenty-one miles distant, 160 fathoms mud. About forty sea-pens (*Pennatulæ*) of a species new to science, and many interesting and rare forms in this haul. I rose at 6 a.m. to see what the mud contained, and at 6.40 another successful attempt was made. Dredge E, Ellis Bay, Anticosti, bearing S.S.W., twenty-seven miles distant, 200 fathoms mud. The temperature on deck was 68° in the shade, and when the bulb was immersed in the mud in the usual way, the mercury sank barely as low as 42°! This puzzled me considerably, as the temperature of the deep sea mud had hitherto ranged pretty uniformly from 37° to 38°. This time, however, several minutes elapsed, after the bulb had been pushed into the mud, before the mercury sank 10°, and nearly half an hour before it sank to 42°,—if it did at all, for, perhaps 43° to 45° would be nearer the proper reading. Whether a warm current affects the temperature of the bottom at this point, or that my observations were inaccurate or defective, (which is highly probable) remains to be seen. A few (ten to twelve) sea-pens of the same species as before, and a very similar assemblage of specimens to those obtained in the last haul, were procured in this. At 2.30 p.m., we were off Griffin's Cove, an hour afterwards we were making for the north shore, and at 6 p.m., were out of sight of land.

Wednesday, August 16th. Off Sawhill Point (Sheldrake) at 9.45 a.m. Dredge F. Sawhill Point, bearing N.E., twelve miles distant, in sixty-nine fathoms on a rocky bottom; consequently very few specimens were collected. Several "crumb of bread" sponges, a sea anemone, a rare star fish identical with one dredged in the *Porcupine* expedition, and since described by Professor Wyville Thompson, several large shrimps, a small specimen of the great spider-crab, (*Chionocates*) a hermit crab inside a dead shell of *Fusus tornatus* a single valve of *Neera artica*, and a specimen each of *Turritella crosa* and *reticulata*, with a few stones, were all that came up. Our course was now changed to one almost due east; wind nearly ahead,—weather misty rather than foggy. At 6 p.m. we were opposite Thunder River. On the north shore, at this point, the Laurentian (?) rocks crop up near the shore, and form low barren hills almost devoid of vegetation, which gives the landscape a desolate aspect. Dredge G. sixty fathoms mud, off Thunder River, bearing N.N.E., ten miles distant. Two fine examples of Agassiz's "basket fish" (*Astrophyton Agassizii*) in this haul, and a few common shells, in all only seven or eight specimens. Passed to the north of the West Point lighthouse at 9 p.m.; saw the light very plainly.

Thursday, August 17th. In the morning among the Mingan Islands; saw several puffins and kittiwakes. Went ashore at Mingan at 10.30; on landing, noticed that there was a small quantity of magnetic iron sand on the beach. Walked through a cranberry swamp to the Mingan River, botanizing on the way; in the dry places there were small Canada balsam and spruce trees, also small junipers: *Potentilla tridentata*, *Stellaria*, &c., and in the wetter places *Spiranthes*, *Ledum*, *Kalmia*, and other ericaceous and marsh plants. During the afternoon, we sailed through the Islands as far as Esquimaux Point, and went ashore there for a short time in the evening. Set sail again about 8, the course being more to the south—towards the north shore of Anticosti.

Friday, August 18th. At 8 a.m., we were between Cape Observation and Bear Head, Anticosti. Fine bold escarpments of a whitish looking (Upper Silurian) limestone, seven good sections visible at once. The dredge had been thrown out and pulled up again before I was up. Dredge H, between Anticosti and the North Shore, Charleton Point (Anticosti) bearing W. by S., eight miles distant. Many stones, some large, others small, came up in the bag, but there were more gneissoid or Laurentian masses than pieces of fossiliferous limestone. Two rare species of sponge, sea anemones, (*Tealia crassicornis*) several shrimps, a few *Amphura* and *Ctenodiscus*, twelve species of shells, two of them brachiopods, and two small fishes, were brought up this time. One of the fishes was a juvenile wolf-fish (*Anarrhicas*), the other a gurnard, of the genus *Agonus*. Dredge I. In 120 fathoms mud, Bear Head, Anticosti, bearing N.W. by W., twelve miles distant. Temperature in the shade, on deck, 60°, in the mud, 38° or 39°. Mixed with the mud were a number of small water-worn stones: some of them were pebbles of labradorite, &c., others of fossiliferous limestone, a few isolated fossil Rhynchonellas were also detected. Recent species: several hydroids, polyzoa, and marine worms, five large examples of *Ctenodiscus*, and eight species of shells, differing materially from those taken in dredge H. Weather sunny and hot.

Saturday, August 19th. Passed the East Point Lighthouse at 8 a.m. Weather showery, with very little wind. We intended to try and examine to-day the locality in which, according to the chart, the depth is 313 fathoms, but were prevented by the weather. Measured our rope in the morning, and found we had about 575 fathoms. Lashed three heavy weights to the line; the first, with a large swab attached in front, two or three fathoms from the mouth of the dredge, the second, 100 fathoms from the first, and the third 100 fathoms from the second. In the afternoon, (2.45 p.m.) we got Dredge J. Dredge J, off the East Point of Anticosti, bearing S. by W., twenty-four miles distant, 212 fathoms mud, with several large stones. On the swab I found seven specimens of a curious crustacean of the genus *Pycnogonum*, and two or three examples of a brittle star, *Ophiacantha spinulosa*. Temperature on deck, 60° in the shade; in the mud 40°. About twenty species visible to the naked eye were obtained in this haul, but the number of individuals was small when it is considered that the dredge brought up upwards of six buckets full of mud. The microscopic organisms in this and the fol-

lowing haul, were since found to be of unusual interest. At 10.15 p.m., the dredge was thrown over again, in nearly the same place, but in a little deeper water, probably 250 fathoms, and was hauled in a little before midnight. This, the last haul on the *Stella Maris*, is Dredge K. A little mud with a few small stones, came up in the bag; the number of specimens obtained was very small. As the wet rope went over the side of the ship, it was luminous throughout its entire length with electric sparks, but the closest scrutiny with a triplet lens, failed to detect any organic matter among the strands.

Sunday, August 20th. A heavy gale from the north west sprung up a little after midnight, and drove us down to the Magdalen Islands. Anchored in the lee of Bryan Island for shelter at 10 a.m., and remained there all day. A very heavy sea on. Went ashore in the afternoon; noticed several Kittiwakes, Gannets, and two Caspian Terns, near the land. The red sandstone of which Bryan Island is composed appears to be of Lower Carboniferous age.

Monday, August 21st. Tried to beat up towards Gaspé Bay but utterly failed. At 7 in the evening we were almost where we started from.

Tuesday, August 22nd. The gale continued till 1 p.m., and was succeeded by a dead calm, then a favorable breeze springing up, at 11 p.m., we sailed for Gaspé Basin and arrived there the next day at 4.30 p.m. Got on board the S. S. *Gaspé* early on Thursday morning, and arrived in Montreal on the following Sunday.

On *La Canadienne* we had sixteen hauls of the dredge. Of these two were failures, the bag coming up empty: four were in fifty fathoms of water, or less; seven in between fifty and 100 fathoms, and five in from 100 to 200 fathoms.

On the *Stella Maris* we had eleven hauls. Of these, two brought up nothing; one was in less than fifty fathoms; two were between fifty and 100, and six between 100 and 250 fathoms.

PART II.

Provisional Summary of the Zoological Results obtained.

At present only the Echinodermata and Mollusca collected have been carefully studied. The Foraminifera, Polycystinae, Sponges, Actinozoa, Polyzoa, and Crustacea, have been examined in a somewhat cursory way, but the Hydrozoa and the marine worms are as yet untouched. In the following sketch a complete list is given of the novelties among the Echinoderms and Molluscs, and such notes on the other groups as the time at my disposal for their examination has permitted. For the loan of books of reference, I am indebted to Principal Dawson, and to valuable practical help in the microscopic dissection of many of the species to G. T. Kennedy, B.A.

Foraminifera.

Very large quantities of these beautiful organisms were collected, but not a twentieth of the whole have been examined, even in the most desultory way. Since the publication of Mr. G. M. Dawson's paper on the Canadian species of this group, published in June, 1870, much additional information on the subject has been amassed. Eleven large bagfuls of mud brought up from various localities, at depths of from 100 to 250 fathoms during the past summer, were preserved: only two of which have as yet been partially examined.

Further research does not, so far, confirm Mr. Dawson's theory, that the foraminifera found at depths greater than 100 fathoms "are very small and delicate." Gigantic examples of *Nodosaria*, *Dentalina communis* and *pauperata*, and of a new Marginuline form, armed with spines longer than in most specimens of *Calcarina*, also *Triloculina tricarinata*, var., are frequent in from 150 to 250 fathoms, and are very plainly visible to the naked eye. My experience is, that the arenaceous species are not more plentiful in Gaspé Bay than in any other part of the River or Gulf of the St. Lawrence. In Mr. Dawson's paper, a list is given of 55 sub-species or varietal forms of

foraminifera from the Gulf and River St. Lawrence. Of these I regard a few as too trifling varieties of other species to warrant the application of a distinctive name, and one of them, *Rhabdopleura abyssorum*, I believe to be an annelid tube, having examined the animal in a living state. On the supposition that in 1870 about 50 sub-species, or pretty well characterized varieties were known to inhabit the seas of the Dominion, it is probable that the researches of the past summer will add at least one-third more to the number. The following species seem most characteristic of the deep water of the River and Gulf, to the east of Newfoundland:—

Lagena distoma, type.

Bulimina pyrula.

" *marginata*.

Valvulina ~~Acetabularia~~

Virgulina squamosa.

Bolivina costata.

" *punctata*.

Triloculina tricarinata.

conical /

Polycystinae.

In Principal Dawson's "Handbook of Zoology," two species of this group are recorded as natives of the seas of Canada. The number of species will be now doubled. One of the new forms appears to belong to the genus *Haliomma*, and it would seem that these beautiful organisms are most abundant in very deep water, in not much less than 200 fathoms.

Sponges.

Five or six species of sponge, new to me, were obtained, most of them in deep water. One is *Grantia ciliata*, the first sponge with calcareous spicules, known to inhabit the seas of Canada.

Another belongs to Bowerbank's genus *Polymastia*, and may be a new species, as it does not agree with any yet described. The rest are undetermined.

Hydrozoa.

Many specimens of this group were collected, but they have not yet been examined.

Actinozoa.

No true corals have been discovered in the Gulf of St. Lawrence, or, indeed, north of the State of Massachusetts, on this side of the Atlantic. The so-called "corals" of the charts are calcareous polyzoa.

The two common sea anemones, viz., *Metridium marginatum*, Say, which is probably a variety of the European *Actinoloba dianthus*, Ellis, and *Rhodactinia Daviesii*, Ag., which also seems to be the species known to European authors as *Tealia crassicornis*, occur as abundantly, living in the greatest depths examined, as in very shallow water.

The most interesting discovery made in this group of animals was that of a fine colony of Sea Pens, living in deep water between Anticosti and the south shore of the St. Lawrence. No true Pennatula had hitherto been found either on the east or west coast of North America, and the genus is consequently new to the continent.

These Sea Pens (so called from their curious resemblance to a quill pen) belong to the genus Pennatula, as restricted by the latest writers. The St. Lawrence Pennatula is probably new to science, it is equally distinct from the Mediterranean species, *P. purpurea* of Ellis, the British *Phosphorella phosphorea* and the Norwegian *Ptilella borealis*.

Pennatula aculeata, ~~Lanielsen~~.

Echinodermata.

The following is a complete list of the deep sea Echinoderms collected:—

Schizaster fragilis. Dub. and Koren. Two living examples.

Calcecia hystrix, ~~Wyele Thompson~~ (Perhaps *Solaster fuscifer* of Duben and Koren)

One specimen. I am indebted to Prof. A. Agassiz for the identification of this Asterid.

This
-921, pag
Journal,
Cten
Oph
Oph
water.
Am
Ast
River.
The
but two
water.

The
consists

On
collected
Nympha
be Dr. S
A. Serra

As
examina
probably
are *Dej*
Acyoni
ciliata,
have be

A
arenosa

A
shells o
followi

T
T
*P
*A
Y

*
I
A
*
*N

Th
ness of

~~This is the star fish so called in the proceedings of the Royal Society, Vol. 18, No. 921, page 445, but not the sea urchin to which that name is also given in the same Journal, Vol. 19, No. 125, page 154.~~

Ctenodiscus crispatus, Lubeu and Koren. Abundant in deep water everywhere.

Ophioglypha Sarsii, Lutken. Very large and abundant in 25 fathoms.

Ophiocantha spinulosa, Mull. Abundant in 100 to 250 fathoms, as well as in shallow water.

Amphiura Holbollii, Lutken. Not rare in deep water.

Astrophyton Agassizii, Stimp. Two fine specimens in sixty fathoms mud off Thunder River. Hardly a deep sea species.

The few echinoderms yet collected in the deep sea of the gulf are all European species, but two of them are new to America. Many common forms were taken in shallow water.

Annélida.

The series of marine worms collected is interesting and curious in the extreme, and consists of more than twenty species, which, however, have yet to be studied and identified.

Crustacea.

Only a very few of these have yet been examined. No large crabs or lobsters were collected in deep water. The most striking of the deep sea crustaceans are a fine large *Nymphon*, perhaps *N. giganteum* Johnst., a *Pycnogonum* taken in 250 fathoms, which may be Dr. Stimpson's *P. pelagicum*, and among the Amphipods, a fine *Acanthonotus* near to *A. Serratus*.

Polyzoa.

As yet a few of the more conspicuous of these have been submitted to microscopical examination. The number of species new to the seas of the Province of Quebec will probably exceed twenty. Two of the most conspicuous and interesting forms obtained are *Deprancia lucernaria*, Sars, and *Retepora cellulosa*, var., *elongata*, Smitt. Specimens of *Alcyonidium gelatinosum*, Pallas; *Flustra Barleii*? Busk; *Acanthopora plumosa*, *Bicellaria ciliata*, *Crisia eburnea*, *Scrupocellaria scruposa*, *Gemellaria loricata*, and *Idmonea atlantica* have been recognised among the species collected.

Tunicata.

A few of these curious molluscoids were met with, one of which seems to be *Molygula arenosa*, the rest are at present undetermined.

Mollusca.

As I wished to avail myself of the opinion of Mr. J. Gwyn Jeffreys, F.R.S., on the shells collected, during his visit to Montreal, these were carefully studied first. The following species were procured from depths of 100 fathoms and upwards:—

Terebratula septentrionalis, Couth.
Terebratella Spitzbergensis, Dav.
 **Pecten Groenlandicus* Chenn. non Sow.
Arca pectunculoides, Scacchi.
Yoldia thraciformis, Storer.
 * " *lucida*, Loven.
 * " *frigida*, Torell.
Dacrydium vitreum, Moll.
Astarte crebricostata, Forbes.
 * " *caulata*, var. *minor*
 **Nucula arctica*, Sars.

**Nucula obesa*, Loven.
Cryptodon Gouldii, Philippi
 **Philine quadrata*, Wood.
Dentalium abyssorum, Sars.
Siphonodentalium vitreum, Sars.
Rissoa caroliniana, Møller.
Aporrhaia occidentalis, Beck.
Eulima stenostoma, Jeffreys.
 **Bela Trevelyana*, Turton.
Buccinum ciliatum, Fab.
Chrysodomus (Sipho) Islandicus, Chenn.

Those species to which an * is attached were identified by Mr. Jeffreys, who also confirms the correctness of the naming of the rest.

A. crenata, Gray,
 teste Jeffreys.

for Meyeri, Friele.

In less than 100 fathoms many interesting species were obtained. Among the rarest of these are the following:—

Terebratella Spitzbergensis, Davidson. Ranges from thirty to 120 fathoms, but is most abundant in shallow water. *T. Labradorensis*, Sow, is a synonym of this species.

Astarte lactea, Brod. and Sow. Living in from thirty to seventy fathoms, in various localities. *inflata*, Stimpson.

Tellina (*Macoma*) ~~new species~~. In eighty fathoms sand off Moisie Village.

Utriculus hyalinus, Turton. From twenty five fathoms sand, in Trinity Bay.

**Lacuna glacialis*, Moller. Ninety six fathoms sand, in Trinity Bay.

Pisces (species undetermined). With the preceding.

**Margarita glauca*, Moller. Thirty fathoms sand, off Sawhill Point.

Ocenebra, new species. Seventy fathoms sand, off Moisie Village.

**Chrysodomus* (*Sipho*) *Spitzbergensis*, Reeve: or a new species. Gaspé Bay.

**Chrysodomus* (*Sipho*) *Sarsii*, Jeffreys. In several places, at depths ranging from fifty to ninety fathoms.

Twenty six species of shells, not previously known to inhabit the seas of the Province of Quebec, were collected during the two cruises. Of these, fifteen are new to the continent of America, and out of the fifteen two are new to science.

Listonina eburnea (Stimpson).

Fishes.

The only fishes brought up by the dredge were a young specimen each of the Norway Haddock (*Sebastes Norvegicus*), the Wolf fish (*Anarrhicas lupus*), and a small Gurnard of the genus *Agonus*.

When the material collected during the past summer has been carefully examined and studied, it is estimated that nearly 100 species of marine animals will be then known which belong almost exclusively to the deep sea in Canada. In depths of from low water mark down to fifty or sixty fathoms, sea-weeds both large and small are very numerous, and the animal life is abundant and prolific. In the deep sea mud, sea-weeds seem to be very rare, (a few frustules of diatoms were all that were collected), the animals are very different from those of shallow water, and seem to be not so numerous either in individuals or in species. Moreover, the deep sea fauna of the St. Lawrence is more Arctic and Scandinavian in its character than is that of the lesser depths. Those who are interested in the study of the fossils of the Canadian Post Pliocene deposits, will be glad to have an opportunity afforded of comparing them with the recent fauna of the deepest parts of the St. Lawrence.

PART III.

Practical Suggestions and Concluding Remarks.

The food fishes of the St. Lawrence may be divided into two groups, viz., those which feed at the surface, as the herring and mackerel; and those which feed at the bottom, such as the cod, halibut, and all the flat fishes. With regard to the surface feeders, no information about their food was collected. No opportunities were afforded of examining the contents of the stomachs of either mackerel or herrings. Four towing nets were provided with the view of capturing floating animals, but almost nothing was taken in these. No Medusæ and no Pteropods were collected, although considerable attention was paid to the use of these nets, especially when many whales were in sight.

I have examined the contents of the stomachs of more than 500 cod fishes, taken in Gaspé Bay, in many places on the north shore of the St. Lawrence, near the Magdalen Islands, &c. The following list will give an idea of the food of this fish, that which occurs most frequently being placed first. Of course, objects, such as sea anemones, which are entirely soft, cannot be readily identified.

1. Other fishes, such as sand launces, capelin, &c.: I have found a small sea-lamprey in a Cod's stomach.

2. Crabs, of the genus *Hyas* mostly.

3. Squid, at certain seasons.

4. Bivalve shells, especially the following: *Glycimeris siliqua*, *Cardium Islandicum*, *Serripes Groenlandicus*, *Yoldia myalis* and *limatula*, and occasionally, other species.

5. Brittle stars, very rarely, generally *Ophiopholis aculeata*.

Judging from the contents of its stomach, it would appear that the cod very rarely feeds at greater depths than fifty or sixty fathoms. By dredging, in comparatively shallow water, one can often observe where cod have been feeding, by the presence in the dredge of empty shells of large cockles, which the cod have swallowed while living, and ejected all but the nutritious portions through the mouth. Cod banks, or as the Gaspé fishermen call them, "reefs," are submarine elevations of the bottom of the sea. One of these banks (between Capes Gaspé and Bon Ami) I examined in 1869, and was amazed at the extraordinary numbers of the minute shells of the foraminifera brought up in the sand from the bottom. It may be that in some cases the abundance on the banks of these microscopic creatures, upon which other marine animals feed, may be the primary cause of the presence of cod in such numbers at these places. Farther up the St. Lawrence, opposite Rivière du Loup, Principal Dawson informs me that cod feed largely on shrimps. Cod fishes are infested with parasites, both external and internal. In European seas no less than five species of parasitic crustaceans attach themselves to the outside of cod, but I have only noticed two kinds on cod from the St. Lawrence. Tape worms occurred in the intestinal canal of Gaspé examples of this fish, and nematoid (?) worms were observed encysted on the outside of the livers of cod caught off the St. John's River.

Halibuts and flounders feed largely upon molluscs, both bivalve and univalve, and they may obtain their food in deep water. At any rate flounders from Portland, Me., offered for sale in Montreal, frozen, have their stomachs full of shells of species exactly identical with those dredged in from 100 to 250 fathoms in the St. Lawrence.

In case Americans are allowed to fish in Canadian waters, the custom (said to be practiced by them) of splitting the fish caught at sea and throwing the offal overboard, on the fishing ground, should not be permitted.

A few words on the edible mollusca of the Dominion may not be out of place here. Some of these are found on the shores of the Atlantic, but about one-half are peculiar to the shores of North America. To the first of these groups belong the razor fish (*Solen ensis*); the two "soft shell clams," (*Mya arenaria* and *truncata*), and the common mussel, (*Mytilus edulis*). All of these inhabit the seas of Canada, and are largely used in Europe as articles of food. The whelk of the American shores, (*Buccinum undulatum*, Møller), may be only a variety of the common British species, and the same may be said of the Canadian oyster, of which the specific relations are still obscure. Of the edible species of molluscs found in Canada, but not in Europe, there are few of any economic importance. The two Canadian cockles are too difficult to obtain, the same is true of one of the two native scallops (which, however, is found on both sides of the Atlantic), *Mactra polynema* is a little more feasible, but by far the best of all is the large scallop known to naturalists as *Pecten Magellanicus*. This species has everything in its favor as an article of food; it is of large size, specimens often measuring five to six inches in diameter, which prevents it being swallowed by fish; it lives in very shallow water, and is, therefore, easy to obtain; and lastly, it is delicious when cooked. I have eaten cooked examples of *Ceronia deaurata*, a bivalve which is common on the beach in many parts of the Gulf, but it makes a poor substitute for the cockles of the old country.

The dearth and scarcity of oysters in England has led to the formation of companies there, whose object is to import these molluscs from Nova Scotia and New Brunswick. In view of this circumstance, as well as in the interests of our own people, it is of practical importance that endeavors should be made to develop our resources in this direction. I take the liberty of offering a few suggestions on this point. It would be of value, I think, if a series of observations on the temperature of the bottom of the sea in various

parts of the coasts of Nova Scotia and New Brunswick were carefully made, with the latest appliances for that purpose. To these should be added a careful examination of the nature of the bottom, and in various localities, with special reference to the presence or absence of such microscopic vegetable and animal organisms as are known to form the bulk of the food of the oyster. Individuals or companies who might endeavor to make oyster beds artificially, would probably find these observations of value. Encouragement should be afforded to persons engaged in artificial oyster culture, or in making experiments with that end in view, by giving such legal protection to interests of this kind, as is done in Great Britain. It might be well to offer a reward for the best essay on artificial oyster culture in the Gulf of St. Lawrence, with special reference to the varieties best adapted for introduction into our waters. Attempts to acclimatize oysters in the seas of the Province of Quebec would, I think, be impracticable, unless (which is not likely to be the case) places should be found where the mean temperature of the bottom is exceptionally high. The northern limit of the oyster in Canada is the south side of the Bay of Chaleur, and in the north of New Brunswick oysters are usually of small size. The laws of New Brunswick and Nova Scotia with reference to oysters are defective, and require reconsideration and amendment.

In 1869, Principal Dawson dredged wood perforated by a species of ship worm, (probably *Teredo dilatata*, Stimpson,) in Gaspé Bay, and in the same year I dredged a piece of waterlogged wood riddled by and full of a small burrowing crustacean of the genus *Limnoria*, in the same locality. When it is remembered that so many ships have been lost at sea, through the ravages of the ship worm that it has been designated by Linnæus the "calamitas navium," and when one reads of the damage done to dockyards in Europe and America, either by the *Limnoria* alone, or by it and the *Teredo*, it behoves us to be on our guard when we learn that these formidable creatures unfortunately inhabit our own shores. Principal Dawson informs me that great damages have already been done to the woodwork of wharves and harbours in Nova Scotia and New Brunswick, by this species of *Teredo*. Mr. Nelson Davis, of Montreal, tells me the brigantine "Magdala," which was built at St. John, N. B., was completely riddled by this ship worm, some time ago, on her first voyage, from St. John to Liverpool. The kind shewed me pieces of the timber of this unfortunate vessel, perforated in every direction with the burrows of this species, and containing the valves and pallets in situ. The whole of the ships bottom had to be renewed and covered with copper sheeting before she was again seaworthy.

If it is borne in mind that only five weeks were spent at sea altogether, and that during this time the ordinary duties upon which the schooners were engaged, often did not allow me to dredge, also that frequently, when opportunities were afforded, the weather was unfavorable, and that I was practically alone (so far as scientific help was concerned) nearly all the time; it is hoped that the results, both in a scientific and in a practical point of view, will be such as to be creditable alike to the Dominion Government and to the society which I have the honour of representing.

It may be mentioned that the cost of the outfit, and extra travelling expenses, amounted to about \$130, of which the Natural History Society of Montreal paid \$94 28, and myself the remainder.

My thanks are specially due, and are hereby gratefully acknowledged to Commander Lavoie, M.D., J.P., F. E. Gauthier Esq. B.A., Captain Leblanc and the officers of *La Canadienne*; also to Captain Lachance and the officers of the *Stella Maris*, for their unvarying kindness and valuable assistance to me while on board their vessels; to J. W. Gregory Esq., of Quebec, also to Mr. Joseph Eden, and other friends in Gaspé Basin, for much courtesy shown to me during a fortnight's stay at that picturesque little town.

MONTREAL, December 2th, 1871.

ade, with the
amination of
the presence
to form the
avor to make
encouragement
king experi-
of this kind,
est essay on
the varieties
ysters in the
ss (which is
ature of the
is the south
ually of small
are defective,

o worm, (pro-
ged a piece of
of the genus
s have been
l by Linnæus
ds in Europe
es us to be on
abit our own
n done to the
y this species
e "Magdala,"
m, some time
me pieces of
e burrows of
e ships bottom
aworthy.

er, and that
ngaged, often
afforded, the
ific help was
tific and in a
Government

ing expenses,
paid \$94 28,

o Commander
officers of *La*
ris, for their
sels ; to J. W.
aspé Basin, for
tle town.